Gerd Renno
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Applicant: Beiersdorf AG, 20253 Hamburg, DE

Inventor: Lühmann, Bernd, Dr., 22846 Norderstedt, DE

Use of a strip of an adhesive tape for separable adhesive joints

Sections of an adhesive tape for separable adhesive joints
a) made from a double-sided adhesive tape,
b) which has adhesive areas on opposing sides at an offset which are not adherent, whereby
c) the non-adherent areas do not, or only slightly overlap, and
d) which allow the adhesive joint made with them to be separated by pulling apart the non-adhesive areas, particularly by pulling in the direction of the adhesive plane.

Description

The invention concerns a section of adhesive tape for separable adhesive joints.

Adhesive tapes of this kind are known. For instance, DE 33 31 016 A1 describes an adhesive tape for separable adhesive joints which allows one to separate an adhesive joint made with it by pulling on the adhesive tape in the direction of the adhesive plane. Large adhesive forces and shear forces can be achieved with these kind of adhesive tapes, and adhesive joints can be separated again without additional tools, comparable to opening a reusable glass with canned goods, where the rubber seal ring is grabbed at the flap and pulled out of the seal slot.

Furthermore, DE 37 14 453 C1 describes an ammunition object for training which can be removed from training objects without destruction by being reversible attached with this kind of adhesive tape.

Also, WO 92/11333 describes an adhesive tape among other things for similar

applications, whereby the adhesive tape in question has a low elasticity at very high elongations at the same time.

DE 42 22 849 C1 describes also a strip of an adhesive tape of this kind with an especially designed flap for grabbing.

However, the adhesive systems described in the above mentioned patent papers also feature a number of disadvantages:

- To be able to pull the adhesive tape out of the adhesive slot, part of the former has to protrude out of the slot to be grabbed. By necessity, the adhesive tape is not completely invisible when objects are glued together which are not flexible, but the flap to grab it is visible which can appear optically as undesirable, and led to technical problems when materials are used which age under the influence of light.

- The whole adhesive tape including the flap to grab it can easily disappear in the adhesive joint during the adhesion process. This can happen especially to a lay person if he does not place a section of the adhesive tape at the edge of the substrate in such a way that a flap to grab it will protrude and extend out of the adhesive joint area. Then it is tricky to separate the adhesive joint and will lead to the destruction of at least one of the substrates.

- If the adhesive tape rips during the separation process and part of the ripped adhesive tape remains in the adhesive joint area, the joint materials can't be separated without residue unless the adhesion components are destroyed which can cause significant damage.

- The use of layers which can not or only slightly be stretched as part of the adhesive tape is not possible. Layers such as these, for example foams, can however be very valuable technical components, for example to achieve good adhesion strength on rough surfaces.

The goal of the invention presented here is to create an adhesive tape for separable adhesive joints which is located completely in the area of the adhesive slot after the adhesion is established, i.e. is invisible, and nevertheless allows one to separate the joint objects in a simple manner without residue and preferably without destruction.

In particular, a flap to grab and pull the adhesive tape out of the adhesive slot should not be required. Also, even if the adhesive tape would ~~rapture~~ rupture during the separation process, it should be possible to separate the adhesion components without destruction. It should be possible to use layers which can not or only slightly stretched as components of the adhesive

tape, and which can be used to create technically important adhesion properties.

Based on this the invention concerns a section of adhesive tape as characterized in more detail in the claims. Advantageous design variations are described in the sub-claims.

A two-dimensional piece of double sided adhesive tape is covered partially with non-adhering material so that a non-adhering region is always located at the opposite side of a sticky region. For handling reasons during the application, the sticky regions are advantageously covered with a laminated separator layer which serves at the same time to protect the adhesive material before use. Optionally the double sided adhesive tape can have additional intermediate layers such as intermediate layers made with polymer tapes, foamed flat area structures, filaments, etc. to name a few. The ends of the double sided adhesive tape can be free of adhesive as another option.

The pieces of the presented adhesive tape are very suitable as a separable adhesive joint for a variety of materials, for example in home and office use. For example posters, papers, small pictures, etc. can be glued in a simple way so that the adhesive tape remains invisible in the adhesive joint area. Other possible applications comprise separable closures for cartons, the separable mounting of photos in photo albums to name a few.

It is possible to separate the mounted object without residue by simply pulling it in the direction of the length axis of the adhesive tape parallel to the surface of the adhesive. The separation process shall happen in such a way that the adhesive regions separate from each other. The simple separation of the mounted object occurs by elongating the double sided adhesive tape starting from the center of the adhesive tape. The loss in adhesion is promoted according to DE 33 31 016 or DE 42 22 849 by reducing the tackiness of the adhesive material, and by the reduction of the adhesive tape thickness caused by the elongation of the adhesive tape.

The act of pulling does not have to be performed precisely. It is not required to pull exactly like that to separate the adhering regions from each other, because even a "crocked" pulling, even in cross direction, will be successful, although in a less elegant manner. Neither is it required to pull in the direction of the adhesive joint. Deviations are also allowed, although it is cautioned to not damage the substrate.

The separation happens in analogous manner in design versions according to this invention with an intermediate layer which ruptures easily such as tissue paper or a thin film, or with an intermediate layer with predetermined places of rupture in the region in which the adhesive tape will be pulled apart, or also by use of highly elastic or not elastic but highly stretchable intermediate layers. In this case as in the case described before a separation free of residue is especially guaranteed with adhesive tapes of the "stripable" type as they are described among others in DE 33 31 016.

Also, products of the type cited in WO 92/11333 can be used accordingly.

The separate the parts pulled off after the adhesive joint is separated, is less easy in designs of the kind according to those invention with an adhesive tape of the more classical type having adhesive material as is used widely for adhesive tapes. However, this does not play an important roll in certain applications, particularly if the residue can remain on the substrate without interfering. If in these or other cases the residues are preferred to be removed, the use of a flap is recommended to easier pull off the remainder. This kind of flap can be especially designed so that the non-sticky regions extend around the edge of the adhesive tape segment, for example several millimeters over the adhesive region located below.

The shear strength of the adhesive joints prepared with adhesive tapes according to this invention is determined by:

- the force which has to be exerted to stretch the adhesive tape (adhesive material and possibly intermediate layer) in length direction;
- the shear strength of the adhesive tape to that of the non-adhering regions if they slightly overlap.

Suitable Materials

Adhesive Tapes (double sided adhesion tapes)

Suitable according to this invention are common double sided adhesive tapes, especially those which release without residue if they are pulled in the plane of adhesion after establishing the adhesive joint. Suitable adhesive materials include those based on natural rubber / lacquer mixtures, synthetic rubber / lacquer mixtures, acrylate copolymers, polyurethanes, etc., to name a few. Especially suitable are adhesive tapes as described in DE 33 31 016, DE 42 22 849, and WO 92/11333. Typical dimensions of adhesive tapes according to this invention are (width x height x thickness) 3 mm x 5 mm x 25 μm to 100 mm x 200 mm x 3000 μm, preferably 5 mm x 10 mm x 50 μm to 40 mm x 80 mm x 1000 μm, and above in case of foamed intermediate layers.

Intermediate Layers

The adhesive tape can optionally contain an intermediate layer to adjust the shear strength and the force necessary to separate the adhesive joint. Suitable materials comprise among others polymeric tapes, felts, foams, filaments. The use of foamed intermediate layers additionally enables one to better wet out the adhesive material in joints with materials of

rough surfaces. The desired rupture strength of intermediate layers is so low that a perfect separation of the joint connection is possible, or a predetermined rupture location with perforation, cuts, or the like is incorporated to allow for a perfect separation.

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Non-adhering Regions

The possibilities to create the non-adhering regions are manifold. It can be achieved for instance, by rendering the adhesive material inert with a non-sticky lacquer. Other possibilities include the lamination of thin, layered materials such as polymer films and paper. If the non-adhering regions overlap slightly, the force required to separate the adhesive joint can be controlled by the shear strength of the adhesive tape against the non-adhering regions as well as the elongation characteristics of the non-adhering regions. In applications films and papers with varnish coatings and without are especially used.

Separation Laminate

The typical release tapes and papers are suitable as separation laminates such as siliconized release films / release papers, which are commonly used as excellent materials separating large areas against adhesive materials.

The reader is referred to DE 33 31 016, DE 42 22 849, and WO 92/11333, generally with regard to manufacturing, processing, and handling of the especially preferred adhesive tapes

In the following examples the invention shall be described by design examples without restricting it unduly. All fractions are understood to be weight fractions.

Example 1

An adhesive material B consisting of a mixture of 50 parts SIS-triblock-copolymer with a block-polystyrene content of 29 %w (Vector 4211, Dexco), 50 parts of a pentaester of partially hydrated Kolophonium (Pentalyn H-E, Hercules), and 1 part of a phenolic aging prohibitor, is extruded at a layer thickness of 600 μm on a double sided, siliconized release paper with 80 g/m^2, and the laminate of adhesive material and release paper rolled into a 50 mm wide jumbo roll. In a second processing step one half of one side of the previous adhesive laminate is first covered (at 25 mm width) with a 30 μm thick siliconized polypropylene film (siliconized side towards the adhesive material), and the remaining open adhesive surface subsequently covered with a 35 mm wide siliconized release paper in such a way that 10 mm of the polypropylene film protrudes over the side to serve later on as a flap

to be able to easier separate the release film. After laminating the double sided siliconized release paper to the adhesive on the opposite side of the adhesive tape, it is covered correspondingly and symmetrically to the first adhesive side by laminating the same polypropylene film and siliconized release paper. Individual pieces of adhesive tape are produced by individualizing with a punch press. Pieces of adhesive tape with the dimensions of 20 mm x 50 mm are obtained.

Adhesive tapes like these are very suitable to join light weight two dimensional structures such as posters, small pictures, etc. or also as closures for cartons. To mount, for example, a poster, the siliconized release paper is removed from one side of the adhesive material and the adhesive tape is mounted with the adhering side towards the top to the substrate which is to hold the poster.

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After removing the release paper from the front side, the poster can be mounted. To securely join it, two pieces of adhesive tape are used which are invisible after mounting the poster (completely covered behind poster) in the vicinity of the top right and left corner of the poster.

To completely remove the poster it is pulled perpendicular to the adhesive joint surface downward.

Example 2

In further processing the master jumbos from Example 1, 30 mm wide siliconized polypropylene release tapes are used to create the non-adhering regions in place of the 25 mm wide polypropylene tapes in such a way that they each overlap by 10 mm in the middle of the release tape, and thereby cause an area of 10 mm in length without adhesion in the middle of the adhesive tape. Pieces of adhesive tape like that are also very suitable to glue light weight, two dimensional structures such as posters, small pictures, etc., as well as to close cartons, for example. In contrast to Example 1, the force required to separate the adhesive joint and thereby the achievable shear strength of the joint depend not only on the elongation characteristics of the adhesive material, but additionally on the shear strength of the adhesive joint between the adhesive material and the siliconized polypropylene tape itself in the region of overlap. The required force to separate and the shear strength of the adhesive joint is thereby increased in comparison to Example 1.

Example 3

Covers with 10 μm thick non-siliconized, biaxially stretched polyethyleneterephthalate

are used in place of the non-adhering laminates of siliconized polypropylene film from Example 2.

The force required for separation is also increased compared to that of Example 1.

Example 4

Analogous to Example 2 a water like, clear, sticky mass of acrylatecopolymer with a thickness of 1200 μm is used in place of the SIS based adhesive material. The acrylate-copolymer material features a rupture strength of about 0.5 MPa. Pieces of adhesive tape like this (Scotch 4910 product from 3M) are also very suitable to join light weight, two dimensional structures such as posters, small pictures, etc.. In contrast to the adhesive tape pieces from Example 2, because of the known excellent aging characteristics of acrylate copolymers, they can be employed especially when very high transparency (for example to join transparent materials), or excellent aging characteristics, for example outstanding UV stability, are important.

Example 5

An adhesive tape laminate consists of a tissue paper with about 13 g/m^2 which is coated on both sides with an adhesive from Example 1, and is processed according to Example 1.

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The force required to separate the adhesive joint, and thus, the shear strength of the adhesion achievable depends additionally on the rupture strength of the tissue paper besides the elongation characteristics of the adhesive material in contrast to Example 1. The force required for separation is therefore higher compared to Example 1. This product displays advantages in its manufacturing. Lifting the adhesive from the master jumbo is prevented when a master jumbo is cut. Furthermore, the base substrate does not interfere with the release process since it ruptures easily.

Example 6

An adhesive tape laminate is made of a 75 μm thick polyurethane based on thermoplastic polyesterurethanes (Platilon UO1) which is coated on both sides at 100 μm with the adhesive material from Example 1 according to the processing described in Example 1. Contrary to Example 1 the force required to release to adhesive joint and the shear strength of the adhesive joint achievable depends additionally on the force necessary to elongate the polyurethane tape beside depending on the elongation characteristics of the adhesive material.

The required separation force is therefore higher compared to that of Example 1.

Example 7

Pieces of adhesive tape consisting of a 3000 μm thick EPDM foam with a density of 65 kg/m^3 and an adhesive coating of 200 μm each on both sides with the adhesive described in Example 1 are manufactured in such a way that the foam is completely cut in the middle of the adhesive tape.

Tapes like that are especially useful to join materials with rough surfaces and/or to attach it to rough substrates, since the ability of the adhesive tape to deform perpendicular to the plane of the tape is significantly increased with the use of the foam which in turn increases the wetting of the rough surface and therefore the adhesion force.

Example 8

An adhesive tape according to Example 2, but only with a 75 μm thick adhesive layer and 35 mm long siliconized polypropylene release films, is also very well suited to glue posters, whereby 5 mm of the release tape are folded over around the adhesive tape at each end of the adhesive tape, and thereby form a flap to hold it. During rapid separation the adhesive joint ruptures with the adhesive laminate because of the low rupture strength. It is still possible to separate the rest of the adhesive tape from the substrate completely without residue if the siliconized polypropylene release films are folded back and the parts of the adhesive tape are being separated by slowly pulling parallel to the plane of the adhesive joint.

Example 9

As an alternative to Example 1 an adhesive tape of similar construction is produced, however with the dimensions of 5 mm x 10 mm x 100 μm (Width x Length x Thickness), and non-adhering cover with 5 mm x 5 mm made of a 30 μm thick siliconized polypropylene release film.

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A material like that is very suitable join reversibly photos and photo albums with adhesive.

Patent Claims

1. Sections of an adhesive tape for separable adhesive joints
a) made from a double-sided adhesive tape,
b) which has adhesive areas on opposing sides at an offset which are not adherent, whereby
c) the non-adherent areas do not, or only slightly overlap, and
d) which allow the adhesive joint made with them to be separated by pulling apart the non-adhering areas, particularly by pulling in the direction of the adhesive plane.

2. A section of adhesive tape according to Claim 1, characterized by being able to be stretched elastically or plastically with or without laminated substrate.

3. A section of adhesive tape according to Claim 1, characterized by the adhesion of the adhesive tape being smaller than its cohesion, by the ability of the tape to adhere vanishing when being stretched, and by the ratio of release force to rupture force being at least 1 : 1.5.

4. A section of adhesive tape according to Claim 1, characterized by the adhesive tape being based on thermoplastic rubber and sticky lacquers with a high degree of elasticity and little plasticity.

5. A section of adhesive tape according to Claim 1, characterized by the non-adhering regions having a non-sticky lacquer or a laminated layer material such as paper or a polymer film.

6. A section of adhesive tape according to Claim 1, characterized by being equipped with no or only a slightly elastic intermediate substrate which possibly is equipped with a predetermined location for rupture such as a cut, a partial cut, or a perforation at the line at which the offset, non-adhering regions meet.

7. A section of adhesive tape according to Claim 1, characterized by the adhesive regions being covered with a release laminate such as a siliconized release paper or release film, whereby flaps are especially designed in to hold and pull off the release laminate.

8. A section of adhesive tape according to Claim 1, characterized by the non-adhering regions being designed in such a way that they extend around the corner, especially the upper and lower edge at the end of the section of adhesive tape, and thereby form a flap which can be grabbed to pull off and separate the adhesive tape section or its residues after the adhesive joint has been made.